Professor Allen Thomson

ANATOMICAL OBSERVATIONS

with the author's compts.

ON THE

ANALOGOUS STRUCTURE AND USES

OF THE

LINGUALIS AND PANNICULUS CARNOSUS MUSCLES.

BY

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OBSERVATIONS, &c.

It is the generally received opinion that the principal uses of the senses, by virtue of the peculiar properties of their nerves, are to make us acquainted, not only with the states of our own body, but also to inform us of the qualities and changes of external nature, in as far as these give rise to changes in the condition of these nerves.

This change, termed sensation, is a property common to all the senses; but the kind of sensation being different in each, —in that of light, of sound, of smell, of taste, and of touch.

When we come, therefore, to review these different senses, and observe the manifold conveniences which they individually confer on the animal exhibiting them, the distribution which has been made of them by physiologists, into those possessing "special properties," and those possessing "properties more or less similar to each other," appears to be one founded on facts which can be easily demonstrated, and on conclusions which must be deduced from the facts so produced.

But if we take up a wider range of inquiry, and extend our researches into the fertile field of Comparative Anatomy, we shall find abundant evidence there, that some of those organs, which in man and in the higher classes of animals perform only the part of a special sense, in others contribute very materially to the performance of general functions, such as the ingestion of food, and the affording of assistance to and defending the animal against the attacks of others. The first of these divisions, the "organs of special sense," comprise the organs of vision and of hearing; whilst the second embraces the remaining three, the organs of smell, of taste, and of touch; but, on analyzing these latter more minutely, it would not be difficult to shew, that their arrangement, physically considered, is not strictly correct.

The organ of vision, for example, requires for its peculiar stimulus to exertion, the existence of luminous rays transmitted to, and impinging on, its special nerve; and the organ of hearing, in like manner, depends for its stimulus on the existence of sonorous undulations excited in, or transmitted to, the media in which its special nerve is situated. The existence and nature of the first of these stimuli, however, can only be proven by negative data,—the scholastic dogma of darkness proving the absence of light,—whilst the physical properties of the latter can be rendered more palpable, and can even be brought within the range of our cognizant senses.

Of the three senses included in the second division, that of smell is the more special in its functions, requiring for its excitement to activity the "local application" of external odoriferous particles possessing the physical properties of matter, and which properties can generally be reduced to a palpable and self-evident existence. No other function, however, can, by any reasoning, be assigned to the nose but that of smell, and the investigation of the minute structure of its component parts, in any class of animals possessing the sense, cannot adduce any facts tending to prove the contrary. This sense, therefore, may be looked on as possessing some of those properties which belong to the division of special senses, at the same time that it also exhibits phenomena (in so far as the physical nature of its stimulus is concerned) which require it to be classed with those of common sensation; in fact it is a link of union between those of special and those of common sensations.

In man, and some others in the higher classes of animals, the tongue seems to serve the function of taste alone; and on investigating the structure and conditions of its upper surface in these, this function can alone be assigned to it.

In taking a review, however, of its uses in the various classes of the vertebratæ, we cannot be justified in considering it as an organ of taste in all of them, although it was long the opinion of naturalists, that "brute animals, especially those which feed upon herbage, and are not liable to be corrupted by example or necessity, distinguish tastes with wonderful accuracy. By the application of the tongue, they instantly perceive whether any plant is salutary or noxious; and to enable them, amidst a thousand plants, to make this discrimination, their nervous papillæ and their tongues are proportionally much larger than in man."* This opinion, however, cannot be tenable on true zoological investigation; and I shall prove in the following pages the very reverse, viz. that the smoother the surface of the tongue and the less developed are its appendages, the more acute is the sense of taste,—verifying what was long ago observed by Shakspeare, that

> "The hand of little employment hath the daintier sense"—*Hamlet*;

and inversely, the more we find these developed, so shall we also observe that the organ acts more as one of prehension than one of taste.

Even in some of the highest classes—the Ruminantia and Felinæ for instance—it principally serves for the prehension and taking in of their food, and it is at least very doubtful whether it possesses the sense of taste in several others, although, on the contrary, we would not be warranted in denying the existence of this sense in these animals, nor even in such as are entirely destitute of the organ, as the function can be performed by other parts, "it not being the effect of a special and limited organ, but a property of the mucous membrane lining the whole of the cavity of the fauces."†

On the Structure of the Surface of the Tongue and the Lingualis Muscle.

It hasbeen long known that, in most of the herbivorous mammalia, particularly the Ruminantia, independent of the epithelium, the dermo-mucous membrane covering the upper surface of the tongue is of a very firm and dense texture, and that it forms, as it were, appendages to itself,—what the hairs, bristles, and quills are to the surface of the body—numerous, strong pointed papillæ, imbricated on each other in a direction from the tip to the base of the organ, and which were supposed, as already stated, to indicate an increased degree of taste in these animals. In many of the Felinæ, the Marsupiatæ, and the bat tribe, the same remarkable peculiarity of structure is observed.

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* Smellie, Philos. of Nat. Hist. vol. i. p. 166.

† Müller, Physiol. vol. i. p. 1059.

In several of the Mammalia the organ is not only used in the turning of the food from side to side, and for aiding in the primary part of the act of deglutition, but it also very materially, nay, in some, very essentially aids in collecting the food; whilst it at the same time serves the purpose of a comb or rasp for the animal cleaning itself. The ox, for instance, with his free tongue, rolls the herbage of the meadow into a kind of tuft, before he tears it through with the lower incisors and palate; and he also rasps and cleans his own coat or that of his companion with its rough and prickly surface. In the dog and cat it is the sole agent by means of which the fluids are conveyed to the mouth by that action of it called "lapping;" and, in short, in every animal using the organ in a similar manner, we have the papillæ on its upper surface correspondingly arranged and developed.

In all these animals, also, the muscular lamellæ of the Lingualis are well developed and very strong, immediately beneath the dense investing membrane of the organ; and taking this fact, with the condition of the papillæ on its upper surface and their evident mode of production and uses, it is curious that no other function should have been assigned to these muscles but that of "shortening the tongue and depressing its point;" actions which, I will endeavour to shew, are only secondary, and the effect of another.

In the following remarks, therefore, I will attempt to point out more specifically what the real uses of these muscles may be; not only as these can be deduced from their anatomical arrangement and distribution, but also from analogical reasoning in regard to their situation immediately beneath the epithelium and dermo-mucous membrane of the tongue. Considered in the latter point, it is evidently the analogous muscle of the panniculus carnosus, and serving to these structures and their appendages what this latter muscle does to the cutaneous textures on the greater part of the surface of the body, viz. the erection or setting on end of these appendages,—the papillæ.

The upper surface of the tongue in ruminating animals and in the dog tribe, is covered over by a very dense and almost cartilaginous membrane, extending from the epiglottis forwards to the tip and over its sides, where it becomes much changed in its appearance and structure, and takes on the nature of true mucous membrane. Along the median line it is much thicker and more dense than at any other part, and appears in the dog in the form of a distinct and rounded cord, commonly called the worm of the tongue, and designated by the Caldani, the "linea albescens."*

Posteriorly this membrane is intimately attached to that which extends between the base of the tongue generally, and the epiglottis and os hyoides, and in structure appears evidently to be similar to the yellow elastic tissue.

On making an oblique section of the entire thickness of this membrane, it appears to differ somewhat in its two anterior thirds from that which is seen in its posterior; and hence it has been looked on by Gerdy as warranting the application of two distinct names,—the "*membrane folliculaire ou muqueuse linguale*," and the "*tissu folliculaire lingual.*"

The first of these, says he, "s'observe dans les deux tiers antérieurs de la membrane linguale, est grise, très-dense, fort résistante, cartilaginiforme, et comme si elle était tapissée par une lame cartilagineuse."

The second, the "tissu lingual folliculaire, est placé sous la muqueuse, très-mince de la partie superieure de la base de la langue. Il occupe le tiers postérieure de la surface supérieur de celle-ci, environ tout l'espace qui est au-delà des papilles lenticulaires et coniques jusqu'à l'epiglotte, et où s'ouvrent les follicules si sensibles. Il adhére aussi tres-fortement à la folliculeuse qui le recouvre immédiatement."† This difference, however, appears to me to be more apparent than real; for, after a most careful examination of their minute structure in the horse, the ox, and the dog, no appreciable difference could be detected, and the only cognizable differences—the thickness and density, appearing rather to be dependent on the comparative absence of the papillæ on its upper surface.

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* Icones Anatomicæ, Venet. 1804.

† Gerdy, Anat. et Physiolog. de Langue: Archives generales de Medecine tom. VII. p. 363.

On the two anterior thirds, where these projections most abound, there the tissue is most dense and strong, and its sensibility is less than in the posterior third, which is well known to be, next to margins of the organ, in the animals above specified, the situation where the sense of taste is most acute over the surface of the organ.

This opinion is still more strengthened by a comparative examination of this investing membrane with that which is found along and under the margins of the tongue. There the structure seems to be in every respect similar to the "*tissu folliculaire.*"*

Projecting from the upper surface of this investing membrane we have a great number of papillæ, varying much in size, form, and arrangement. They are largest and most prominent in the middle and anterior thirds, particularly along the centre of each section, but more scattered along the margins.

In their directions, when viewed laterally, and the tongue of the animal is kept in the bottom of the mouth, they appear to lie flat along the surface, but imbricated on each other from before backwards; their apices looking towards the epiglottis. No sooner, however, is any sapid body or any other stimulus applied to the surface, than they are immediately elevated. When thus seen in the tongue of the dog or cat, they appear arranged in comparatively regular and transverse lines, the apices then being lifted up, and their posterior surfaces rendered concave, so that we have now a series of small channels well adapted for containing and supporting fluids placed in them, and thereby transporting them into the back of the mouth, during the pendent position in which the head of the animal is then placed.

In their structure, they are similar to that of the investing membrane, and their adherent surfaces are attached to the anterior extremities of the superficial lingual muscles.

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* See also Blandin, Archiv. Gén. de Méd. 1823; also his Thèse Inaug. sur la structure de la langue de bœuf.

Immediately beneath this investing membrane, we find the irregular bands of muscular fibres to which the term *lingualis* has been applied.

These bands have been arranged by Gerdy into four sets, "the superficial and deep, the vertical and transverse lingual muscles;"* but it is only the first of these which is the most conspicuous, and can alone act on the surface of the tongue and its papillæ.

This muscle consists of two distinct lamellæ of fibres, extending from the base to the tip of the organ, and separated from each other by the linea albescens. In their general outline and configuration, they are slightly parabolic; their concavities looking towards each other along the median raphè, and their convexities to the margins of the tongue. Posteriorly they arise by means of the glosso-epiglottic elastic tissue from the upper surface of the os hyoides, and from thence proceed forwards to the different portions of the adherent surface of the investing membrane. The inner set of fibres are considerably the shortest; but they gradually become more lengthened as they are examined near the margins. Their free or inserted extremities are into the whole of the lower surface of the investing membrane. This can be proved by two facts,—first, by the roughened appearance of the dissection after its most careful removal, this condition evidently depending on the severing of the muscular fibres from it in their transverse direction; and secondly, from our inability to trace, even by the aid of a glass, any of the muscular fibres forming this layer curving downwards to the base of the organ,—the general tendency of all the muscles of the tongue, the intrinsic and extrinsic, being towards its upper surface and tip.

Immediately beneath these layers of muscular fibres, we find another layer of comparatively loose cellular tissue surrounding the free extremities of the different muscles of the body of the tongue. This layer is very vascular, being freely supplied by terminal branches of the lingual arteries.

In some animals, as the chameleon, it is better developed than in others, and in this animal forms a distinct layer of erectile tissue, which becomes tense and turgid during the sudden and rapid darting of the organ on its prey.

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* Recherches d'Anatom. &c. Paris, 1823, p. 20.

Where it is not so well developed, the rete malpighi chiefly serves the purpose of enabling the superficial lingual muscles to be freely and easily moved from before backwards over the surface of the tongue, unconnected and unrestrained by the influence of the other muscles, from which they are completely separated. Analogously considered, it is similar in situation and use to the adipose layer on the surface of the body, which separates the panniculus carnosus from those muscles which are in immediate connection with the trunk, and thereby has its action confined to the common investing membrane and its appendages.

Having thus traced the fibres of the muscles, and seen that they are extended along the whole of the upper surface of the organ, and fixed posteriorly to the os hyoides, it will be easy to observe, that this latter must be the part whence it can become fixed before it can be called into action. Taking this, therefore, as its point of fixion, whenever it contracts, either by the will of the animal or by the presence of some stimulus, it becomes shortened in its length, and puckered, as it were, into transverse folds ; and it will also be observed, that, in consequence of the intimate attachment of the anterior extremities of the fibres to the adherent surface of the investing membrane, this must also be shortened and wrinkled in a corresponding ratio. No sooner, therefore, will this be effected, than its immediate and free prolongations, the papillæ, will have their bases drawn backwards along with it, and with the natural consequence of lifting up and tilting forward their apices ; so that when the entire muscles are in a complete state of contraction, and the investing membrane shortened to its greatest possible condition, the whole of the papillæ on the dorsum of the tongue are raised up, and arranged, as already stated, in nearly regular undulating lines ; serving thereby as so many tenter-hooks for assisting in laying hold of the grass in the herbivora, and forming so many hollow channels or buckets for lifting up, and containing safely,—like the boxes of a circular chain-pump or dredging machine—the fluids in such of the felinæ as take in this part of their food by lapping.

The generally received opinion of the action of these muscles, viz., "of bending up the tip of the tongue," can only therefore, be a secondary effect, following the perfect evolution of the papillæ; but I doubt much if the muscles ever act in this manner, seeing there is a sufficient number of more powerful ones to perform it.

Structure and Uses of the Panniculus Carnosus.

This muscle, the Platysma Myoides of authors on human anatomy generally,—the Musculus Cutaneus of Winslow,—the Quadratus Genæ of Douglas,—the Latissimus Colli of Albinus, and the Panniculus Carnosus of Zootomists, is entirely cutaneous, and almost peculiar to quadrupeds, and, from its close connection to the skin, it was formerly regarded as one of the common exterior coverings of the body.

In structure and external conformation it differs much in man from that which is found in the generality of quadrupeds with well developed cutaneous appendages.

In the former it is entirely rudimentary, and confined solely to the anterior and lateral regions and the upper part of the chest, whilst in the latter it is spread over the lateral parts of the body, extending forwards upon the shoulder along the neck to the head, and backwards upon the belly and over the hind quarters as far as the stifle or knee-joint.

In the human subject it has the appearance of a thin fleshy lamella extended over the fore and lateral parts of the neck, from the upper third of the thorax, to the lower part of the face. In form it is quadrilateral, somewhat broader above and below than in its middle. Its fibres originate in the fat and cellular tissue covering the inner part of the deltoid and the greater part of the pectoralis major, and generally extending itself downwards as far as the upper half of the capsule of the mammary gland. From this scattered origin the fibres gradually coalesce and ascend obliquely upwards and inwards to the symphysis of the lower jaw. There the muscles of either side come in contact with each other, and again expand themselves to become inserted into the integuments of the chin, the external oblique ridges of the lower jaw and the muscular substance forming the angles of the mouth. These latter constituting the risorius santorini, are often joined by another band of fibres from behind the ear,—from the orbicularis palpebrarum, or the zygomatic muscles.

The general use of the muscle in man is twofold; if it takes its fixed point below, it will then depress and carry outwards the angle of the month and the lower jaw; and by an inverse mode of action it draws the integuments of the neck upwards, arranging the folds transversely, and indicating the use of the muscle in quadrupeds; and by its extension over the mamma in the female, it will compress the upper half of the gland against the anterior wall of the thorax, and thereby tend to squeeze the milk out of the upper part of the lacteal reservoir, whilst the pressure of the head of the child during the act of sucking will have the same effect on its lower half.

In mammiferous animals, with the exception of a few as the hog, the panniculus carnosus is much more perfectly developed than what we find in man. In those animals of this class, which are covered with spines, as the echidna, the hedgehog and the porcupine, and in those covered with scales, as the manis and armadillo, we find it particularly strong and well developed, and performs in all of these the same important functions, that of erecting the dermic appendages, and in coiling or uncoiling the body.

In the Marsupiatæ it is extended over the pouch, and has an additional origin from the marsupial bone.*

In two animals of these different classes we find the muscle particularly strong, viz., the hedgehog and the horse.

In the former of these, it is very complex in the arrangement of it fibres. When carefully dissected, it is of an oval form, placed chiefly along the back, adhering closely to the skin; and can also be distinctly seen to be attached to the roots of the prickles or spines, which generally extend entirely through the cutaneous covering, for a short way into the substance of the superficial fascia. It covers the greater part of the trunk of the body, and has at least six points of osseous attachment. Posteriorly it arises from the outer part of the thigh, immediately above the patella, and from this point it proceeds forwards and upwards to invest the trunk of the body, and at the same time to send a prolongation along either side of the tail to its extremity. Having covered the abdomen and trunk, the inferior margin of the fibres collect themselves into a bundle, which become inserted by one or two tendons under the head of the humerus, along with the tendon of the great pectoral muscle, whilst the superior margin of the fibres pass along the sides of the throat to be inserted into the poll and sides of the cheek.

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* Grant's Outlines, page 174.

By the posterior attachment of the muscle becoming the fixed point, the general integument is drawn backwards and wrinkled transversely, and the greater number of the spines being pointed backwards, have their attached extremity drawn backwards, whilst their apex is lifted from the body, and directly pointed to any object which threatens harm to the animal. By the contraction of the muscle in this way, assisted by the flexor muscles of the head and trunk of the body, the animal when in danger can coil itself up as in a sac. Again, by the fibres taking their anterior extremity as the fixed point, the skin and spines previously elevated can again be placed into their natural situation, and braced more or less closely to the body, as the state of external circumstances may demand.

In the latter animal, the horse, it can be traced much easier from before backwards, and is found to have the same general attachments as in the hedgehog. Its most anterior origin is by means of a few pale scattered fibres, traceable as high as the root of the ear,. and the muscles lying along the side of the face.

These scattered fibres become strong and convergent about the angle of the jaw, when they become spread out over the lateral parts of the neck, blended on either side with the levator humeri. From this its cervical portion, some little fleshy bundles are seen running towards the spine of the scapula, to which they are loosely attached by abundance of cellular membrane; whilst others, paler and less distinct, are continued downwards over the shoulder-joint, when they become blended with the fascia covering it and the arm. There is thus formed a broad but strong fleshy expansion upon the side of the trunk, which takes a direction upwards and backwards to the spine, to which they are only indirectly fixed by a thin fascia, no fleshy fibres extending higher than the top of the scapula. Upon the posterior and inferior parts of the belly the fibres are arranged into a fan-like band, which is continued into the fascia, covering the stifle joint, whence a portion of it is reflected inwards, to be inserted into the pubis, having previously expanded over the mammary glands, upon which this band of fibres specially act. The fibres of the "pannicle" are strongest just behind the scapula and upon the more prominent parts of the belly, whilst anteriorly they become intimately mixed with the fibres of the levator humeri. The general insertion of the muscles may be said to be directly into the skin that every where covers it; and on this texture it can alone act, seeing it is completely isolated from the deeper seated parts, by an universal layer of fascia, which thereby enables it to slide more freely upon them. When in action, the fibres throw the skin into folds that form right angles to their general course; the chief points from which they act, being the angle of the jaw, the scapula, the patella, and the pubis. By suddenly and repeatedly wrinkling the skin, the horse startles and dislodges those insects with which he is during the summer months continually infested, and he has also the power of displacing foreign bodies of considerable weight or magnitude from his body; often indeed he is not only enabled to displace the greater part of his harness, but by the acquirement of a vicious habit, he shakes himself so violently, that the most expert rider can scarcely keep his seat.

"So habitual indeed does this cutaneous action become, that the muscle seems often to contract involuntarily, or at least unheeded by the animal, on the application of the slightest irritant; this is particularly evident when a horse that is grazing or feeding is annoyed with flies."*

Independently of the general use already assigned to the panniculus carnosus, viz. that of erecting the hairs, bristles, and spines, for the purpose of serving as a means of defence, it als performs in some animals a very prominent part in the process of lactation.

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* Girard. Anat. Veterin., tom. i. page 233.

In the kangaroo, so helpless is the condition of their young when born, that they have not inaptly been called, "mammary fœtuses," in consequence of their dependence on these organs, for their future support and developement. "The mammæ act, at first like a true placenta, as permanent conductors of nutrition, and not as in the higher mammalia, a mere storehouse to be resorted to occasionally. This imperfect state of the fœtus for the obtaining of the milk is amply compensated for by the increased power and development of the panniculus carnosus in the marsupial cavity. Taking an additional fixed point at the margins of the marsupial bones, it expands itself over the body of the inferior marsupial glands or mammæ. By its contraction, at the will of the parent animal, and the consequent passive compression of the body of the gland against the abdominal parietes, the reservoirs of the milk-tubes are emptied of their contents, and carried into the alimentary canal of the helpless young one."*

Having thus pointed out the situation, structure, and uses of the two muscles, I shall now conclude the present observations by pointing out the striking analogy that exists between them in every respect. The panniculus carnosus we find to be broad and lamellar, placed immediately beneath the investing membrane of the surface of the body, inserted into its adherent surface, and acting chiefly on its appendages,—the hairs, bristles, and spines,—and wherever we find these most prominently developed, there we also find the muscle correspondingly so; in fact, whenever the surface of the body does not perform chiefly the function of the organ of touch, but rather acts as a means of defence to the animal.

The lingualis muscle we have also seen to be in its conformation broad and lamellar, and placed beneath an investing membrane—that of the tongue—and surrounding the whole of its upper and more exposed surface. Like the panniculus, we have also seen it to be intimately attached to the adherent surface of this investing membrane, and acting chiefly on its appendages—the papillæ; and like that muscle, whenever we find these appendages large and well developed, and when the organ does not perform so much the office of a limited and special function,—that of taste—but rather that of a general kind—that of prehension and ingestion of the food—there do we also find the lingualis particularly developed.

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* Linnean Trans. vol. xvii. 1828, and Cycloped. of Anat. & Physiol. vol. iii. page 251, article *Mamma*.

Finding, therefore, the varying peculiarities of these two muscles, in their situation, connection, and general development, to be so strikingly similar,—is it not probable that in their general uses in the animal economy they will also be similar?

Viewing then all these points of correspondence in the two muscles, I am inclined to consider the Lingualis muscle as entirely a subcutaneous muscle, performing to the surface of the tongue and its appendages what the Panniculus carnosus does to the surface of the body, viz. the erection, or setting on edge of the various papillæ.

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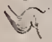

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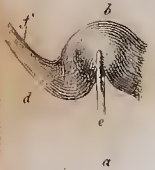

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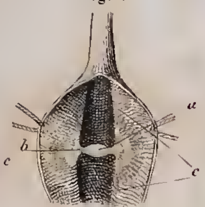

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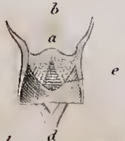

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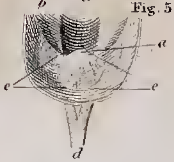

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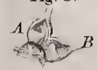

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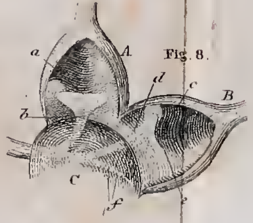

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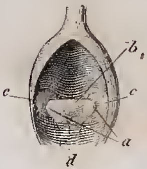

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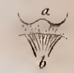

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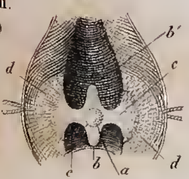

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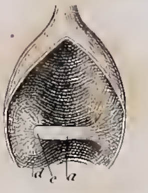

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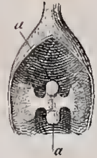

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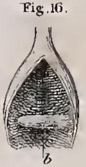
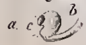


Fig. 17.



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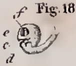

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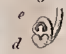

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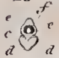

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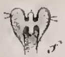

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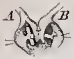

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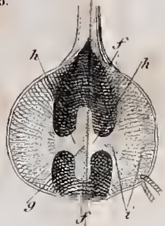

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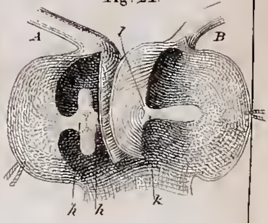

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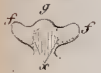

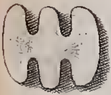

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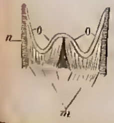
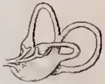


Fig. 27.

Fig. 28.



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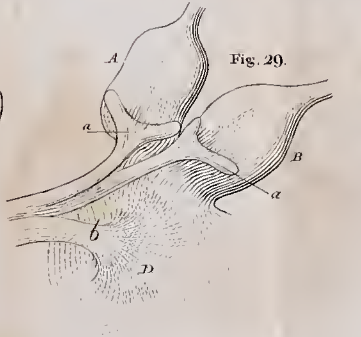

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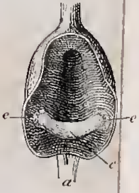

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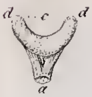

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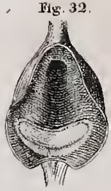

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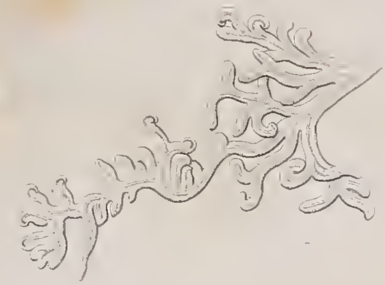
Fig. 5.



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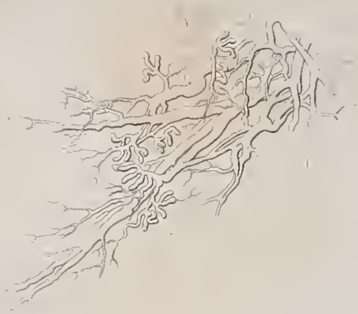

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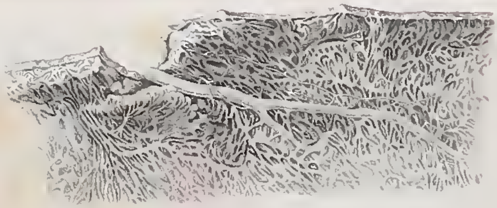
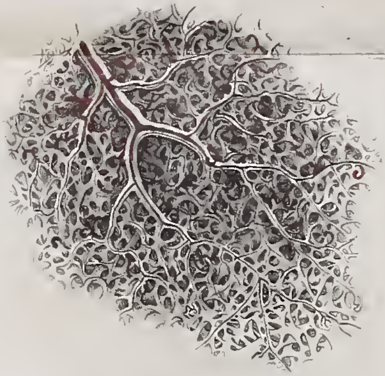


Fig. 1.



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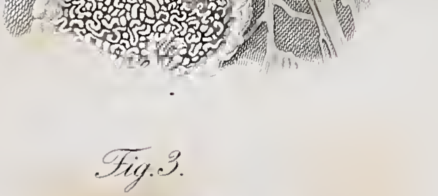
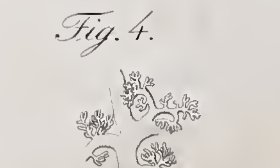


Fig. 2.



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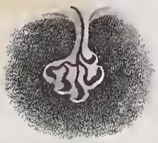

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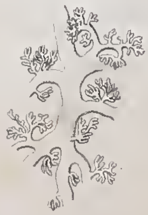

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